P1 1194178

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office

July 21, 2004

THIS IS TO CERTIFY THAT ANNEXED HERETO IS A TRUE COPY FROM THE RECORDS OF THE UNITED STATES PATENT AND TRADEMARK OFFICE OF THOSE PAPERS OF THE BELOW IDENTIFIED PATENT APPLICATION THAT MET THE REQUIREMENTS TO BE GRANTED A FILING DATE.

APPLICATION NUMBER: *60/467,925*
FILING DATE: *May 05, 2003*
RELATED PCT APPLICATION NUMBER: *PCT/US04/14414*

By Authority of the
COMMISSIONER OF PATENTS AND TRADEMARKS

M. Tarver

M. TARVER
Certifying Officer

PRIORITY DOCUMENT
SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

Attorney's Docket No.: 133814/GLOZ 2 00154P

PROVISIONAL APPLICATION UNDER 37 CFR 1.53(c) TRANSMITTAL LETTER

TO THE ASSISTANT COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

Transmitted herewith for filing is the Provisional Patent application of:

Chis Bohler
4930 Corkwood Drive
North Royalton, OH 44133
Citizenship: USA

Boris Kolodin
2634 Brentwood Road
Beachwood, OH 44122
Citizenship: USA

Emil Radkov
26241 Lakeshore Blvd., Apt. 670
Euclid, OH 44132
Citizenship: Bulgaria

Entitled: **METHOD AND APPARATUS FOR LED-BASED SPECIALITY LIGHT BULB**

Enclosed are:

8 Pages of **SPECIFICATION**

3 Pages of **DRAWINGS**

XX A **CHECK** in the amount of $160.00 for the Provisional application Filing Fee is enclosed.

XX The Commissioner is hereby authorized to charge any additional fees which may be required at any time during the prosecution of this application without specific authorization, or to credit any overpayment, to Deposit Account No. 06-0308.

CERTIFICATE OF EXPRESS MAIL

I hereby certify that this **TRANSMITTAL AND PROVISIONAL PATENT APPLICATION** are being deposited with the United States Postal Service by Express Mail Procedure in an envelope addressed to: Mail Stop Provisional Patent Application, Commissioner for Patents, Alexandria, VA on May 5, 2003. Express Mailing Label No.: EL 341152176 US.

Georgeen B. George

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government:

XX No

__ Yes, the name of the U.S. Government agency and the Government contract number are:

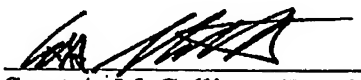
_____

Direct all telephone calls to: Scott A. McCollister
telephone: (216) 861-5582
facsimile: (216) 241-1666
e-mail : SMccollister@faysharpe.com

Address all correspondence to:

Scott A. McCollister
FAY, SHARPE, FAGAN,
MINNICH & McKEE, LLP
1100 Superior Avenue,
Seventh Floor
Cleveland, Ohio 44114-2518

5/5/03
Date



Scott A. McCollister, Reg. No. 33,961
FAY, SHARPE, FAGAN,
MINNICH & McKEE, LLP
1100 Superior Avenue, Seventh Floor
Cleveland, Ohio 44114-2518
(216) 861-5582

METHOD AND APPARATUS FOR LED-BASED SPECIALTY LIGHT BULB

Background of the Invention

The present invention relates to the art of LED lighting systems. It finds particular application in specialty LED-based light bulbs and will be described with particular reference thereto. It is to be appreciated that the present invention is applicable to other types of lighting including, but not limited to, home and industrial lighting. Those skilled in the art will appreciate applicability of the present invention to situations where it is desirable to replace a traditional light package with an LED-based light for increased durability, light output stability and energy savings.

Typically, light bulb packages utilize a light source that includes an incandescent filament within a glass enclosure. However, an incandescent filament is fragile and tends to gradually degrade during use causing the useful light output to decrease over time. The increasing fragility of the filament with age eventually leads to breakage. Typical incandescent light bulbs have a mean life of 500 to 4,000 hours. This means that half of a population of light bulbs will fail in that time because of filament breakage.

Confronted with the above disadvantages, the use of light emitting diodes is an attractive alternative as a potential light source in a light bulb package. Light emitting diodes (LEDs) are well-known solid state devices that generate light having a peak wavelength in a specific region of the light spectrum. A low-power, solid-state LED light could last up to 100,000 hours (eleven years), far outdistancing the life of a typical bulb. When the LED degrades to half of its original intensity after 100,000 hours, it is at the end of its useful life, although the LED will continue to operate with diminished output. Besides producing little heat and being energy-efficient, LEDs are solid-state devices with no moving parts. LEDs characteristics do not change significantly with age, and they are not easily damaged by shock or vibration. This makes LED lighting systems very reliable.

The small shape and low heat generated by such LEDs enables lighting systems to take on various shapes and sizes.

LEDs have often been used for indicator lights on electronic devices and in vehicles. However, the use of LED lighting has still been limited because LED manufacturers encounter the problem of producing white light. Initially, designers tried mixing red, blue, and green LEDs into a single array with the combined result achieving the desired white. While this arrangement can work, slight variations among LEDs of the same color means that each array must be tuned individually to achieve just the right shade of white. Accordingly white light LEDs dependent on phosphor materials for wavelength conversion have been developed. Unfortunately, as the consuming public has because familiar with the appearance of incandescent lamps--particularly for decoration and specialty applications--it has been difficult to achieve widespread introduction of LED lamps.

The present invention provides a new and improved LED lamp.

Summary of the Invention

According to one embodiment of the invention, a lamp is provided which includes at least one LED phosphor to receive the light generated by the at least one LED and convert it to visible light, with a substantially transparent enclosure at least partially enclosing the LED and phosphor. In addition, a light element is provided which provides the appearance of a filament.

In accord with various embodiments of the invention the phosphor can be coated on the light element or can form a component on or adjacent the LED. Preferably, the light element is comprised of a light guide, an optical fiber, or a reflective metal.

In accord with another embodiment, the lamp can be constructed such that the substantially transparent enclosure includes a phosphor coating or integral phosphor material such that the LED generated light excites the phosphor within the lamp, thereby providing a visible light with the appearance of a frosted incandescent bulb.

According to a further embodiment, the lamps include a base adapted for mating with an AC socket, and electronics for converting AC current to DC current,

such as a printed circuit board hosting the at least one LED. Preferably, a heat sink is also provided for conducting thermal energy from the at least one LED to the base element.

Still further advantages and benefits of the present invention will become apparent to those of ordinary skill in the art upon reading and understanding the following detailed description of the preferred embodiments.

Brief Description of the Drawings

The invention may take form in various components and arrangements of components, and in various steps and arrangements of steps. The drawings are only for purposes of illustrating the preferred embodiments and are not be construed as limiting the invention.

FIGURE 1 is a cross-sectional view of an LED-based lighting system having a filament element including a phosphor.

FIGURE 2 is a cross-sectional view of an LED-based lighting system with phosphor applied to the top of the LED, and further including a reflective metal filament element.

FIGURE 3 is a cross-sectional view of an LED-based lighting system with a phosphor applied to the bulb shaped enclosure.

Detailed Description of the Preferred Embodiment

With reference to FIGURE 1, a lighting system **10** is depicted. At least one LED **12** is mounted on a substrate **14**. Substrate **14** can be, for example, a printed circuit board, metal substrate, heatsink, or any other suitable means for mounting the LED. The LED assembly may be mounted into the appropriate socket **16** for easy field exchange and retrofitting. In order to provide suitable electrical power to the LEDs, an AC/DC converter (not shown) is utilized. This will permit the LED-based light to be powered by a standard domestic 120VAC or international 220VAC user voltages making it a true replacement for incandescent. The AC/DC converter may be integrated into the LED assembly or located remotely. A thermal path is provided to conductively pull the heat from the LED and the drive electronics to the socket **16** and/or the sides of the lamp enclosure **24**. Examples of

suitable materials for mounting the LED include copper, aluminum, silicon carbide, boron nitride and others known to have a high coefficient of thermal conductivity.

With further reference to FIGURE 1, the LED **12** emits light **18** (e.g. UV or blue) that strikes a light guide **19**, including a phosphor coating **20** providing the appearance of a filament. The light guide **19** can be a plastic or glass shaped so as to simulate a filament-look and coated with phosphor or formed with phosphor disposed therein. The phosphor composition can include two or more phosphors to convert the emitted light **18** to white light or visible light **22** as might be required by the application. The visible light **22** exits through lamp envelope **24**. Preferably, the enclosure **24** is a standard glass enclosure or transmissive plastic enclosure of the same format as traditional white specialty incandescent bulbs to make the LED based lights an easy replacement. Preferably, the lamp envelope **24** will be comprised of a material or include a coating which substantially reflects any UV radiation.

With reference to FIGURE 2, a "filament-look" LED based light bulb is depicted. As with the other embodiments, socket **16** can be one of existing incandescent designs such as 6S6 screw base, 194 wedge base, etc. Phosphor composition **20** is combined with LED **12** as known to those skilled in the art. Accordingly, emitted light is converted to visible light **22** generally at the LED. In addition, to provide the appearance of an incandescent lamp, visible light **22** strikes a filament shaped light reflector **30** to simulate a "filament-look" light bulb. The light reflector **24** may be a suspended reflector and may be used to simulate the filament shape, such as tin foil, a coiled aluminized spring, fiber optic coil or the like. The light guide embodiment of FIGURE 1 or the reflector embodiment, can be suspended by mechanical bracketing to the substrate, LED, heat sink, lamp envelope or socket.

As shown by the embodiments of FIGS. 1-2, the phosphor may be located in any suitable location, such as integrated into the LED, at the light guide or both.

With reference to FIGURE 3, the phosphor **20** may also be applied to the inner surface of the lamp envelope **24**, which can be either glass or plastic. This will

provide for a "frosted bulb" appearance and does not require an object to simulate a filament-like appearance.

The invention has been described with reference to the preferred embodiments. Modifications and alterations will occur to others upon a reading and understanding of the preceding detailed description. It is intended that the invention be construed as including all such modifications and alterations insofar as they come within the scope of the appended claims or the equivalents thereof.

CLAIMS:

Having thus described the preferred embodiments, the invention is now claimed to be:

1. A light source comprising:

at least one LED;

phosphor to receive the light generated by the at least one LED and convert it to visible light;

a substantially transparent enclosure at least partially enclosing said at least one LED and said phosphor; and

a light element providing the appearance of a filament.

2. The light source as set forth in claim 1, wherein the phosphor comprises a coating on said light element.

3. The light source as set forth in claim 1, wherein the phosphor is adjacent at the least one LED.

4. The light source as set forth in claim 2, wherein the light element is comprised of a light guide.

5. The light source as set forth in claim 3, wherein said light element is comprised of a light guide.

6. The light source as set forth in claim 2, wherein the light element is comprised of an optical fiber.

7. The light source as set forth in claim 3, wherein the light element is comprised of an optical fiber.

8. The light source as set forth in claim 3, wherein the light element comprises a reflector.

9. The light source as set forth in claim 8, wherein the reflector is comprised of a reflective metal.

10. The light source as set forth in claim 1, further comprising a base adapted for mating with an AC socket.

11. The light source of claim 10, further comprising electronics for converting AC current to DC current.

12. The light source of claim 1, further comprising a printed circuit board hosting said at least one LED.

13. The light source of claim 1, further comprising a heat sink for conducting thermal energy from said at least one LED to said base element.

14. A light source comprising:

at least one LED;

phosphor to receive the light generated by the at least one LED and convert it to visible light;

a substantially transparent enclosure at least partially enclosing said at least one LED;

a phosphor material coating or disposed in said enclosure; and

a screw or wedge base for providing electrical interconnect.

LED-BASED SPECIALTY LIGHT BULB

Abstract of the Invention

A light source comprising at least one LED, phosphor to receive the light generated by the at least one LED and convert it to visible light; a substantially transparent enclosure at least partially enclosing the at least one LED and phosphor, and a light element providing the appearance of a filament.

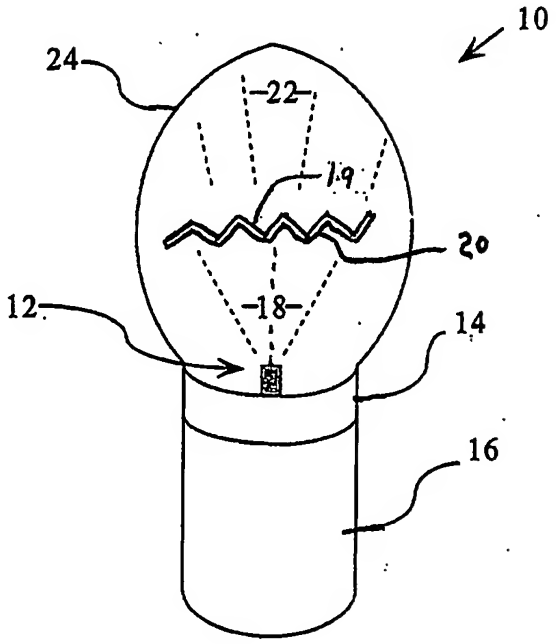


FIG. 1

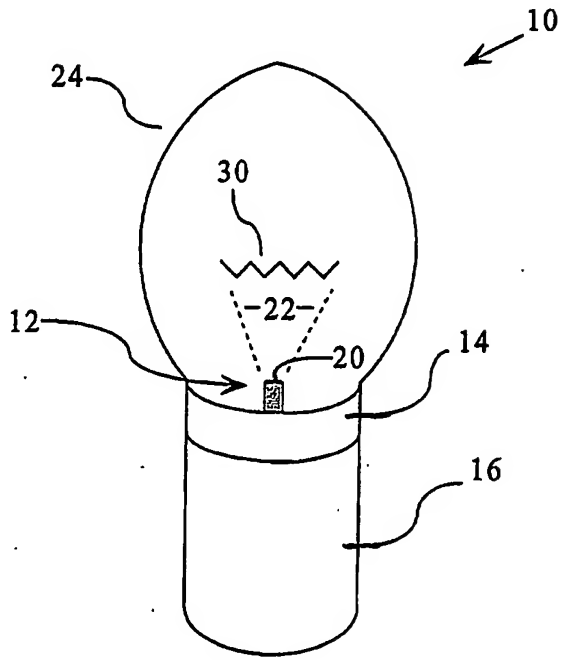


FIG. 2

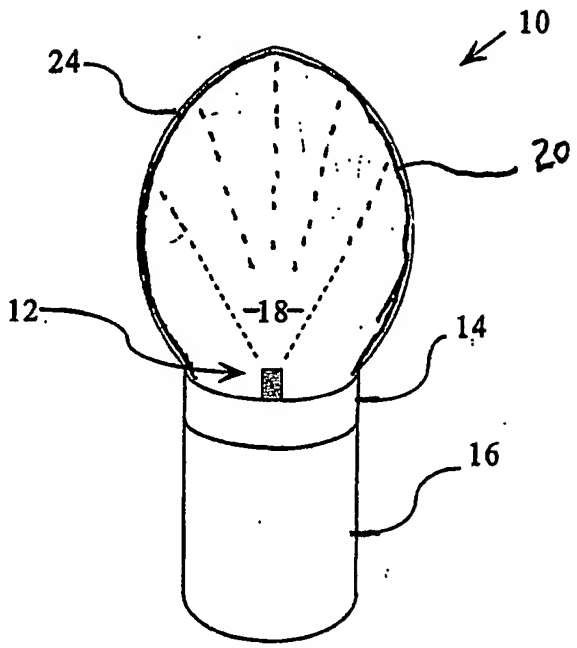


FIG. 3